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North American species of Calceolaria

PHILIP DOWELL

(WITH PLATES 18–22)

The first records we find of plants belonging to this genus of Violaceae are those of Pehr Lōfling, a Swedish naturalist, who was employed by the Spanish government to study the natural history of Spain. Among the specimens collected by him in South America were three species of violaceous plants which he described under the generic name *Calceolaria* (Iter Hisp. 183. 1758). His descriptions were full, but he did not designate the species by binomials. Linnaeus published these three species with binomials in 1763, but he assigned them to *Viola*. In 1766 Dr. A. B. Kōlpin published a German edition of Lōfling's Iter, and at the head of each of the three species of *Calceolaria* the corresponding binomial given by Linnaeus is inserted. According to Kōlpin these insertions were made by Linnaeus, who also had edited the 1758 edition of the Iter after Lōfling's death. Thus *Calceolaria* dates from 1766 and is to be credited to Lōfling. Jacquin's *Hybanthus* (Enum. Pl. Carib. 2. 1760) is a different genus and does not include any of our species. Sprengel (Jour. Bot. Schrad. **4**: 192. 1800) proposed the name *Solea* for Ortega's *Viola verticillata*, which he described and figured. The name that seems to have been more in use than either of the preceding is *Ionidium* (Vent. Jard. Malm. *pl. 27*. 1804), the type of which is *I. polygalaefolium*, the same species as Sprengel's *Solea verticillata*.

Out of some 45 species described, about 20 species of *Calceolaria* have been reported as found in North America, including

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the West Indies; a few occur in the Old World, and the rest are South American. The North American species are found chiefly in Mexico, only a few having been reported from Central America and the West Indies, and only one from the United States. The species included in this paper are only such as are represented by specimens in the Gray Herbarium of Harvard University, in the herbaria of the United States National Museum, Columbia University and the New York Botanical Garden, and in the private herbarium of Mr. T. S. Brandegee.

CALCEOLARIA Löfl. (Iter Hisp. 183; hyponym. 1758) Reise 244. 1766. Type, *Viola Calceolaria* L.

SOLEA Spreng. Jour. Bot. Schrad. **4**: 192. 1800

IONIDIUM Vent. Jard. Malm. *pl. 27*. 1804

Herbs, or rarely small shrubs, with simple alternate or opposite leaves and axillary or racemose flowers. Peduncles or pedicels one-flowered, solitary in the axils of the leaves or bracts, mostly bibracteate near the middle, articulate above the middle. Sepals unequal, not appendaged at the base. Lower petal largest, saccate or gibbous at the base; the two lateral petals longer than the upper pair. Stamens alternate with the petals, each of the lower with a gland or spur at the base, membranaceous at the top by the prolongation of the filament above the anther; anthers connivent. Capsule few-ovuled, otherwise similar to that of *Viola*. Seeds ovoid-globose with hard seed-coats; "embryo straight, central in the fleshy perisperm; cotyledons ovate."

Analytical key

Lower petal less than twice the length of the sepals.	
Flowers axillary.	
Leaves narrow, linear to oblong, usually entire.	1. *C. verticillata.*
Leaves wider, usually ovate.	
Petiole short or none.	2. *C. glutinosa.*
Petiole 1 cm. long or longer.	3. *C. tenuifolia.*
Flowers racemose.	4. *C. fruticulosa.*
Lower petal twice as long as the sepals or longer.	
Stipules minute, 5 mm. or shorter.	
Plant procumbent, small.	5. *C. procumbens.*
Plant erect or ascending.	
Leaves alternate or clustered.	
Flowers long-peduncled.	6. *C. longipes.*
Flowers short-peduncled.	7. *C. glabra.*
Lower leaves usually opposite.	
Leaves about twice as long as broad or shorter.	
Leaves crenulate-serrate, glabrate.	8. *C. brevis.*

Leaves crenate-serrate, pubescent. 9. *C. verbenacea.*
Leaves more than twice as long as broad.
Leaves mostly linear, the lowest sometimes wider.
Leaves obovate to oblong-linear, 2–3 cm. long. 10. *C. stricta.*
Leaves lance-linear to linear, 4–8 cm. long. 11. *C. angustifolia.*
Leaves mostly lanceolate.
Leaves gradually tapering at the base. 12. *C. riparia.*
Leaves truncate or abruptly tapering at the base. 13. *C. nigricans.*
Stipules larger, foliaceous.
Leaves ovate to orbicular, mostly obtuse.
Leaves mostly opposite. 14. *C. humilis.*
Leaves mostly alternate. 15. *C. Rosei.*
Leaves lanceolate to linear. 16. *C.* sp.

1. CALCEOLARIA VERTICILLATA (Ort.) Kuntze

Viola verticillata Ort. Dec. **4**: 50. 1797.
Solea verticillata Spreng. Jour. Bot. Schrad. **4**: 192. *pl. 6.* 1800.
Ionidium polygalaefolium Vent. Jard. Malm. *pl. 27.* 1804.
Viola polygalaefolia Poir. Enc. Meth. **8**: 647. 1808.
Ionidium lineare Torr. Ann. Lyc. N. Y. **2**: 168. 1828.
Ionidium stipulaceum Nutt.; Torr. & Gray, Fl. N. Am. **1**: 144. 1838.
Calceolaria verticillata Kuntze, Rev. Gen. Pl. 41. 1891.

This species is reported as "intertropical both in the New and the Old World." It has been found as far north as Colorado and is common in the southwestern states and in Mexico. It shows considerable variation in the length and shape of its leaves, which are short and obovate in some specimens and long and linear in others, with numerous intermediate forms.

2. CALCEOLARIA GLUTINOSA (Vent.) Kuntze

Ionidium glutinosum Vent. Jard. Malm. *pl. 27.* 1804.
Viola glutinosa Poir. Enc. Meth. **8**: 647. 1808.
Solea glutinosa Spreng. Syst. **1**: 803. 1825.
Calceolaria glutinosa Kuntze, Rev. Gen. Pl. 41. 1891.

The specimens collected on ballast near Communipaw Ferry, N. J., by *Jos. Schrenk*, July 20, 1880, and by *Addison Brown*, September, 1880, are like the South American specimens. There

are specimens from Communipaw Ferry in the Gray Herbarium, the U. S. National Herbarium, and in the Columbia Herbarium in the N. Y. Botanical Garden.

3. **Calceolaria tenuifolia** sp. nov. (PLATE 18)

Stem herbaceous, erect, branching, somewhat striate, loosely puberulent, 3 dm. high or taller; branches erect or ascending, weak, similar to the stem; leaves opposite below, alternate above, the blade ovate-lanceolate, gradually tapering to a blunt apex, abruptly decurrent on the petiole at the somewhat oblique and rounded base, thin and lax, nearly glabrous, light-green, paler beneath, with low distant teeth, subciliate, 3–7 cm. long, 1.5–2 cm. wide; petiole very slender, channeled, puberulent, 1 cm. long; stipules linear, ciliolate, 2–3 mm. long; flowers 2–3 mm. long, axillary, nodding, on filiform finely puberulent peduncles, which are less than 1 cm. long; bracts on the peduncles slightly below the middle; sepals oblong, obtusish, nearly glabrous, finely ciliolate; lower petal 3 mm. long, about one third longer than the sepals, spatulate, notched, winged near the base, glabrous.

The specimens were not in the fruiting stage, so the characters of the fruit were not observed.

LOWER CALIFORNIA: San José del Cabo, *T. S. Brandegee, no. 18*, type. Specimens in the Gray Herbarium and in Brandegee's herbarium, collected September 6, 1890.

4. CALCEOLARIA FRUTICULOSA (Benth.) Kuntze

Ionidium fruticulosum Benth. Bot. Voy. Sulph. 7. *pl. 2.* 1844.

Ionidium fruticulosum dentatum A. Gray, Proc. Am. Acad. **5**: 154. 1861.

Calceolaria fruticulosa Kuntze, Rev. Gen. Pl. 41. 1891.

The type locality is Cape San Lucas, Lower California, from which locality there are specimens in all the herbaria mentioned in this paper.

It should be noted here that some of the specimens show two sets of leaves that are quite different in general shape and aspect. The older leaves may be described as thin, membranous, with veins prominent beneath; alternate, ovate-lanceolate to linear-lanceolate, gradually tapering to the apex, more abruptly tapering at the base and decurrent on the petiole, dentate with prominent unequal rather distant teeth, 3–6 cm. long, 1–2 cm. wide, with petiole 0.5–1 cm. long. The younger or later leaves are mostly

linear, entire or subentire, with shorter petiole. Bentham's description and figure were evidently made from specimens that had lost the older or larger leaves. Gray's variety *dentatum* is based on specimens having the larger leaves present.

Calceolaria fruticulosa flavescens var. nov.

Herbaceous, erect, branching, glabrous; leaves ovate to ovate-lanceolate, more uniform than in the type of the species; petioles longer; inflorescence more decidedly racemose. The lighter-colored stem suggests the name.

SONORA, MEXICO: Guaymas, *Dr. E. Palmer, no. 253* (October, 1887), type; and *no. 258* (October, 1897); *T. S. Brandegee*, November 7, 1893.

5. CALCEOLARIA PROCUMBENS (Griseb.) Kuntze

Ionidium procumbens Griseb. Cat. Pl. Cub. 11. 1866.
Calceolaria procumbens Kuntze, Rev. Gen. Pl. 41. 1891.

C. Wright no. 1898, collected in western Cuba, 1860–4, is the plant referred to by Grisebach in his description. Specimens are in the Gray Herbarium, the U. S. National Herbarium, and the Columbia Herbarium in the N. Y. Botanical Garden.

6. **Calceolaria longipes** sp. nov. (PLATE 19)

Stem erect, branched above, woody at the base, terete, ridged or striate, pubescent, about 2 dm. high; leaves alternate, crowded above, ovate to oblong-elliptical, abruptly narrowed at the rounded oblique base, appressed-pubescent especially on the upper surface, ciliolate, serrate with gland-tipped teeth, thin, dull-green, paler beneath, the veins prominent on the under side; 2–7 cm. long, 1–3.5 cm. wide; petioles pubescent, channeled, somewhat flattened, 1–2 cm. long; stipules linear, slender and minute, ciliolate; flowers erect or nodding, axillary, on puberulent filiform peduncles, which are 2–3.5 cm. long; lip 3-nerved, rhombic-ovate, obtuse, pubescent outside, glabrous inside, much involute in dried specimen, 3 times as long as its claw, 9–10 mm. long, 8–10 mm. wide; claw slender, channeled, puberulent; lateral petals veiny, 5-nerved, slightly exceeding the sepals; upper pair of petals oblong, about two-thirds the length of the sepals; sepals lanceolate, acuminate, 3–5-nerved, ciliolate, puberulent on the veins, nearly equal, 3–4 mm. long; capsule rather small, ovate, obtusely 3-angled, hairy, capped with the persistent style, which is nearly as long as the capsule; seeds minutely pitted, one in each of the three cells, straw-colored.

CHIAPAS, MEXICO: *E. W. Nelson no. 2961*, type. Specimens in the U. S. National Herbarium, collected August 18, 1895, between San Richardo and Ocozucuantla, alt. 800–1000 m.

7. **Calceolaria glabra** sp. nov. (PLATE 20)

Stem erect, flexuous, angular, puberulent to glabrous; leaves alternate, obovate to elliptical, acuminate, gradually tapering at the base and decurrent on the petiole to the stem, crenulate-serrate, glabrous, or finely puberulent and pale on the under side, 7–14 cm. long, 3–4 cm. wide including the winged petiole, which is 2–3 cm. long, the lower leaves smaller; stipules linear-lanceolate, somewhat puberulent, 1–3 mm. long; flowers axillary on puberulent peduncles which are 0.5–1 cm. long; sepals thin, ciliolate, linear-lanceolate 3-nerved, 4 mm. long; lip orbicular, veiny, about as long as its puberulent claw, which widens toward the base; lateral petals falcate, 3-nerved or faintly 4-nerved, 5 mm. long; upper petals oblong, 1-nerved; connectiles of all the stamens puberulent on the outside; capsule large, smooth and veiny, with prominent beak, 8–10 mm. high.

VERA CRUZ, MEXICO: *Charles L. Smith no. 1840*, type. Specimen in the U. S. National Herbarium, collected in 1894 at Banderilla near Jalapa, alt. 1200–1400 m.

8. **Calceolaria brevis** sp. nov. (PLATE 21)

Branching from a woody base; branches ascending, pubescent in two lines; leaves mostly alternate, short-petioled, obovate to ovate, tapering at both ends, crenate-serrate, hispidulose, paler on the under side, 2–5 cm. long, 1–2 cm. wide; stipules minute, lanceolate-subulate, ciliolate; flowers nodding, axillary, on slender puberulent peduncles which are 10–12 mm. long, the bracts opposite at or near the articulation; sepals lanceolate, acuminate, ciliate, puberulent, obscurely 3-nerved, about equal, 3 mm. long; lip 3-nerved, veiny, broadly rhomboid-orbicular, abruptly contracted at the base, 3–4 mm. in diameter; claw somewhat channeled, puberulent, broadest near the base, winged, longer than the lip and exceeding the lateral petals, which are falcate and 4-nerved; upper petals oblong-obovate, 3-nerved, veiny, glabrous; connectile of the lower stamens puberulent on the outside; capsule subglobose, glabrous, with a short thickened beak, each cell with about two orbicular seeds.

GUATEMALA: *Heyde & Lux* in John Donnell Smith's distribution *no. 3943*, September, 1892, and *no. 4435*, May, 1893, type. Specimens in the Gray Herbarium, the U. S. National Herbarium,

and the Columbia Herbarium in the N. Y. Botanical Garden, collected at Volcan Jumaytepeque, Depart. Santa Rosa, alt. 1,850 m.

In the Gray Herbarium is one sheet labeled *E. T. Heyde no. 449.* 1892. This is the same as *no. 3943* in J. D. Smith's distribution, and these specimens were probably all collected at the same place. Those collected in May, 1893, show the growth of a different season, with more simple stem and larger leaves. The leaves on the more numerous branches of the September growth are smaller than those of the main stem, and since only few of the stem-leaves are retained in this stage, the general appearance of the plants in the two stages is quite different.

9. CALCEOLARIA VERBENACEA (H. B. K.) Kuntze

Ionidium verbenaceum H. B. K. Nov. Gen. & Sp. **5**: 379. *pl. 497.* 1821.
Solea verbenacea Spreng. Syst. **1**: 803. 1825.
Calceolaria verbenacea Kuntze, Rev. Gen. Pl. 41. 1891.

E. Palmer no. 55, July, 1880, collected at Coahuila, Mexico, is here considered as belonging to this species. Specimens are in the Gray Herbarium, U. S. National Herbarium, and the Columbia Herbarium. This determination is based on comparison of the specimens with the published description and plate in H. B. K. Nov. Gen. & Sp. and not on comparison with authentic specimens, and I am not entirely satisfied that our plants are the same as those described as *I. verbenaceum.*

10. CALCEOLARIA STRICTA (Vent.) Kuntze

Ionidium strictum Vent. Jard. Malm. *pl. 27.* 1804.
Viola stricta Poir. Enc. Meth. **8**: 648. 1808.
Solea stricta Spreng. Syst. **1**: 803. 1825.
Calceolaria stricta Kuntze, Rev. Gen. Pl. 41. 1891.

Found in Mexico according to Grisebach, otherwise in the West Indies. San Domingo is given as the type locality, from which there is a specimen in the U. S. National Herbarium collected by *Wright, Parry & Brummell*, January-March, 1871. In the Columbia and the Gray herbaria are specimens collected by *C. Wright* in Eastern Cuba, *no. 20*, 1856–7.

11. **Calceolaria angustifolia** (H. B. K.)

Ionidium angustifolium H. B. K. Nov. Gen. & Sp. **5**: 377. 1821.
Solea longifolia Spreng. Syst. **1**: 803. 1825.

MEXICO: San Luis Potosi, *C. G. Pringle no. 5011*, August 21, 1891. Also Prov. Huasteca, near Tantoyuca, *L. C. Ervendberg no. 210*, September, 1858. These specimens are in the Gray Herbarium.

The determination is based entirely on description. Sprengel considers his *Solea longifolia* a variety of *S. stricta*.

12. CALCEOLARIA RIPARIA (H. B. K.) Kuntze

Ionidium riparium H. B. K. Nov. Gen. & Sp. **5**: 378. 1821.
Ionidium parietariaefolium DC. Prod. **1**: 308. 1824.
Solea riparia Spreng. Syst. **1**: 803. 1891.
Calceolaria riparia Kuntze, Rev. Gen. Pl. 41. 1891.

Whether the large number of specimens that have been considered as belonging here are varying forms of the same species or not is a question that could best be answered by field work. I hesitate to put down *I. parietariaefolium* as a synonym of *I. riparium*, but DeCandolle's description of *I. parietariaefolium* is too meager to make sure of his plants. His variety *Houstoni*, however, is recognizable in some of the herbarium material. We include here under *C. riparia* such specimens as *Wright no. 859* from Sonora, Mexico, collected in 1851; *E. Palmer no. 1826* from Tepic, Mexico, 1892; and *T. S. Brandegee's* specimen from El Taste, Lower California, November, 1902. These specimens differ considerably, however, from such as *E. Palmer nos. 25* and *93* from Chihuahua, Mexico, 1885, and *C. G. Pringle no. 6391* from Morelos, Mexico, July, 1896.

Calceolaria riparia Houstoni (DC.)

Ionidium parietariaefolium Houstoni DC. Prod. **1**: 308. 1824.

This is characterized chiefly by its more prominently sharp-toothed leaves. Here we include such specimens as *M. Bourgeau no. 2661* from Orizaba, Mexico, 1865–6, and *Rose & Hay no. 6158* from Vera Cruz, Mexico, August 16, 1901.

13. **Calceolaria nigricans** sp. nov.

Stem woody, puberulent, terete; leaves alternate, the blade ovate-oblong, mostly acute and pointed, truncate and somewhat

oblique at the base, glabrate, serrulate with low rounded teeth furnished with white callous points, firm, 3–7 cm. long, 1.5–2.5 cm. wide; petioles slender, terete, puberulent, 4–12 mm. long; stipules minute, subulate, about 1 mm. long; flowers solitary, axillary, nodding; peduncles filiform, finely puberulent, 1–3 cm. long; sepals lanceolate, 4–5 mm. long; lip of the lower petal rhombic-ovate, 6 mm. long, longer than the claw; capsule 6 mm. long, with a short beak.

HONDURAS: *C. Thieme* in J. D. Smith's distribution *no. 5127*, type. Specimen collected in May, 1889, at San Pedro Sula, Santa Barbara, alt. 250 m.

14. CALCEOLARIA HUMILIS Rose & Dowell; Rose, Contr. U. S. Nat. Herb. **10**: 125. *pl. 42*. 1906

Perennial; stem herbaceous, branching from the woody base, 1–2 dm. high; branches decumbent or ascending, pubescent in two lines; leaves opposite, short-petioled, the blades 1–3 cm. long, 1–2 cm. wide, orbicular to ovate, acute or obtuse, glabrous, crenate-serrate, decurrent on the ciliolate petiole, which is about 2 mm. long; stipules subulate to lanceolate and foliaceous, 4–8 mm. long, glabrous; flowers violaceous, nodding, on slender axillary puberulent peduncles, which are 6–8 mm. long, the bracts opposite near the articulation; sepals lanceolate, acuminate, 3-nerved, glabrous, 4 mm. long; lip orbicular, slightly longer than the claw, 4–5 mm. long; the claw broadly winged, 5-nerved; lower stamens puberulent on the lower part of the connectile above the gland-like appendages; capsule ovoid-globose, with a blunt beak, glabrous.

VALLEY OF MEXICO: *C. G. Pringle no. 9653*, type. Specimen in the U. S. National Museum, collected July 30, 1901, on lava fields near Tizapan, alt. 2300 m.

15. **Calceolaria Rosei** sp. nov. (PLATE 22)

Stem erect, simple or branched, angular and grooved, pubescent with spreading hairs; leaves alternate, short-petioled, obovate to ovate, mostly obtuse, abruptly narrowed at the base and decurrent on the petiole, crenate, hirsute, rather firm, paler on the under side, 2–4 cm. long, 1–2 cm. wide; stipules lanceolate, ciliate, puberulent, variable in size, some foliaceous; flowers axillary, nodding, on slender puberulent peduncles, the minute bracts variable in position; sepals lanceolate, acuminate, ciliate, pubescent, 3-nerved, about equal; lip 3-nerved, glabrous, rhombic-orbicular to broadly ovate, abruptly contracted on the narrow claw; claw

channeled, puberulent, about equaling the lip; petals glabrous, veiny, the lateral falcate, 4-nerved, the upper oblong, 3-nerved; connectiles of lower stamens puberulent.

MEXICO: *Rose & Hough no. 4851*, type. Specimen in the U. S. National Herbarium, collected July 11, 1899, at Guanajuato.

16. CALCEOLARIA sp.*

Specimens of the plant referred to were collected by *T. S. Brandegee*, March 2, 1889, on Santa Margarita Island, Lower California, and are preserved in the Gray Herbarium and in his own private herbarium. The specimen in Mr. Brandegee's herbarium is mounted on the same sheet with two others, all labeled *Ionidium lineare*, and is designated by the figure 2.

It does show a general resemblance to broad-leaved forms of *Calceolaria verticillata* (*Ionidium lineare*), but it is quite distinct from this on account of its larger flowers with the lower petal twice the length of the sepals. On account of its large foliaceous stipules it is placed in the last group and not with *C. stricta* nor with *C. angustifolia*.

Explanation of plates 18–22

PLATE 18. *Calceolaria tenuifolia*

a, whole plant, × ⅔; *b*, opened flower, × 4.

PLATE 19. *Calceolaria longipes*, × ⅔

a, petals; *b*, sepals; *c*, lateral view of flower; *d*, dorsal view of flower; *e*, young capsule; *a*, *b*, *c*, *d*, *e*, all × 2.

PLATE 20. *Calceolaria glabra*, × ⅔

a, petals, × 3; *b*, sepals, × 3; *c*, stamen, × 6⅔; *d*, mature capsule, × 2.

PLATE 21. *Calceolaria brevis*, × ⅔

a, petals; *b*, sepals; *c*, stamens; *d*, lateral view of flower; *a*, *b*, *d*, × 2, *c* × 5.

PLATE 22. *Calceolaria Rosei*, natural size

a, upper petals; *b*, lateral petal; *c*, lower petal; *d*, one of the upper sepals; *e*, one of the lower sepals; *f*, upper stamen, dorsal view; *g*, lower pair of stamens, dorsal view; *h*, side view of one of the lower stamens showing the appendage at the base; *i*, flower; *a*, *b*, *c*, *d*, *e* × 3; *f*, *g*, *h* × 4; *i* × 2.

Plates 19–21 were drawn by Prof. Homer D. House, of Clemson College, South Carolina.

* No description is given, and thus no name, because material is not accessible at present. When specimens were accessible the description was deferred in the hope of getting access to more and better material.

The identity of Mucor Mucedo

Guy West Wilson

The modern genus *Mucor* dates from the first edition of Linnaeus's Species Plantarum * in which eleven species are named. Of these only *M. Mucedo* is retained in the genus by modern mycologists while the others are distributed among various genera of Lichenes, Myxomycetes and Hyphomycetes. According to the Genera Plantarum † of 1754 the genus is coextensive with "Mucor *Mich.* 95. Mucilago *Mich.* 96. Lycogala *Mich.* 95." It is interesting to note that none of Micheli's species of *Mucilago* or of *Lycogala* appear among the Linnaean species, of which *Mucor Mucedo* alone is common to both authors. This species is, therefore, the type of the genus. For this reason it is important to know to what Linnaeus applied the name and whether it is used in the same sense to-day. An examination of Linnaeus's citations and of their collateral references is amply sufficient to determine the first point while recent mycological literature holds a wealth of information upon the second.

The citations in the Species Plantarum ‡ are as follows:

"6. Mucor stipitatus, capsula globosa. *Mucedo.*

Mucor filamentis granulatis fugacibus putrescentibus innatis. *Fl. lapp.* 534. *Fl. suec.* 1119. *Roy. lugdb.* 520.

Mucor vulgaris, capitulo lucido per maturitatem nigro, pediculo griseo. *Mich. gen.* 215. *t.* 95. *f.* 1.

Mucedo capitulo diaphano deinde viridi & postremo nigro. *Malp. vegetat. t.* 25. *f.* 108. *p.* 2.

Habitat in variis putridis: pane, plantis, &c."

The first series of references ultimately reduce themselves to the second. The genus *Mucor* was originally founded by Micheli § with four species. A translation of his characterization is as

* Pages 1185 and 1186. 1753.

† Page 493.

‡ Page 1185.

§ Nova Plant. Gen. 215. *pl.* 95. 1739.

follows: "*Mucor* is a genus of globular plants which are usually stipate but sometimes sessile, all bursting irregularly and containing a cavity in which are numerous small rounded seeds which are affixed to a placenta." With a single exception these characters are all drawn from *Mucor vulgaris* which is further described as having a white head (capitulum) which turns black at maturity and is supported by a grey stripe. The elaboration of the genus is followed by a reference to certain experiments conducted by Micheli, during the autumn and winter of 1718–19, for the purpose of determining the validity of species among the fungi. One of these experiments * deals entirely with *Mucor vulgaris* and is described in detail. On the 5th of November a piece of pumpkin was sown with the spores (semina) of the black mould and placed in the sun. By the 10th of the month the infected portion of the substratum appeared white and was covered with long slender threads resembling white wool. Two days later these were about an inch high and by the 12th were assuming a grayish tint. A few of the filaments also bore white heads which were matured by the 15th. Spores from this culture were sown the next day upon the same substratum and by the middle of January following six generations of *Mucor* had been cultivated from a pedigreed strain.

The account of these experiments contains the key to the identity of Micheli's *Mucor vulgaris* and the Linnaean *M. Mucedo.* They may be duplicated by infecting a piece of pumpkin or sweet potato with the spores of the mould which passes current as *Rhizopus nigricans* Ehrenb. That the identity of these species is beyond question is evident from Micheli's own writings. This conclusion is further strengthened by his reference to Malpighi † who describes the stoloniferous habit of this mould and figures the collapsed columellae.

With this identity in mind it is interesting to trace the "historical usage" of *Mucor Mucedo.* Between 1753 and 1790 this mould was reported from all the principal countries of central and

* Observatio II. *l. c.* 137.

† Anat. Plant. 2: 64, 65. *pl. 28. f. 108.* Reproduced in Malp. Opera Omnia 1: 142, 143. *f. 108.*

western Europe, and frequently described and figured.* The descriptions all agree in a most satisfactory manner, the figures are all referable to the same species, the habitat agrees with that given by Linnaeus and Micheli, the synonymy is in the main correct. No new name was proposed either for this or for a closely related species until Bulliard† published his *Mucor sphaerocephalus*, which he himself admits is but a second rechristening of *M. vulgaris*. The first real step toward complicating the synonymy of the species was taken by Tode‡ when he redescribed it as *Ascophora Mucedo*. Some years later Ehrenberg redescribed the stoloniferous habit of the species, renamed it *Mucor stolonifer* § and later made it the type of the new genus *Rhizopus*.‖ A few years later Link¶ recognized as valid species a number of forms of *Mucor Mucedo* which differed from each other in substratum and in characters for which the substratum and the stage of development would account.

The confusion became so great that Fresenius** attempted to bring order out of the chaos. After examining the figures of *Mucor Mucedo* L., *Ascophora Mucedo* Tode and *Rhizopus nigricans* Ehrenb. from the time of Malpighi down, and contrasting the descriptions of these species he decided that there were no characters upon which to separate the genera and that therefore "we had best return to the old genus *Mucor*, and with Link recognize a *Mucor stolonifer* (*Rhizopus nigricans* Ehrenb.) and *Mucor Mucedo*, of which last *Mucor ascophorus* Link and *Ascophorus Mucedo* Tode are merely synonyms." So far the results of this work appear to unravel the nomenclatural tangle of the species in question. Permanent results would have rewarded his labor had he not fallen into a still graver error than that which he strove to counteract,

* Monti, Bononiensi Acad. Comment. 3: 141–159. *pl. 1.* Bologna. 1755. — Hudson, Flora Anglica 504. 1762. — Scopoli, Flora Carniolica 67. 1760. — Wulff, Flora Borussica 1. 1765. — Haller, Hist. Stirp. Helv. 3: 113. 1768. — Oeder, Flora Danica *pl. 467. f. 4.* 1769. — Bolton, Fung. Halifax 3: 132. *pl. 132. f. 1.* 1789. — Lightfoot, Flora Scotica 1072. 1789. — Bulliard, Herb. France *pl. 480. f. 2.* 1789.

† *L. c.*, and Champ. France 112. 1791.

‡ Fungi Meckl. Sel. 1: 13. *pl. 3. f. 22.*

§ Sylvae Myc. Berol. 13, 25. 1818.

‖ Nova Acta Acad. Leop. 10[1]: 198. *pl. 11. f. 1–6.* 1820.

¶ Willd. Sp. Pl. 6[1]: 85ff. 1824.

** Beitr. Myk. 4–13. 1850.

and described and figured in detail, under the name of *Mucor Mucedo* L.,* the plant which is now known by that name; this, however, had never appeared in botanical literature until 1791 when Tode described it as *Hydrophora stercorea*.† The *Mucor Mucedo* of Linnaeus and the older mycologists is a black mould which grows profusely upon bread, fruits and other vegetable substances, while the *Mucor Mucedo* of Fresenius and his followers (de Bary, Zimmermann, Brefeld and the vast majority of modern mycologists) is a gray mould which inhabits dung of various animals and appears upon vegetables substances as rarely as does the first species upon dung.

The chief synonymy of the two species of moulds which have at various times passed under the name *Mucor Mucedo* L. is as follows:

1. MUCOR MUCEDO L. Sp. Pl. 1185. 1753.

   Mucor vulgaris Mich. Nova Plant. Gen. 215. *pl. 95. f. 1.* 1729.

   Mucor sphaerocephalus Bull. Herb. France *pl. 480. f. 2.* 1789. Not *M. sphaerocephalus* L. 1753, nor *M. sphaerocephalus* Batsch 1783.

   Ascophora Mucedo Tode, Fungi Meckl. Sel. **1**: 13. *pl. 3. f. 22.* 1790.

   Mucor ascophorus Link, in Willd. Sp. Pl. **6**[1]: 85. 1824.

   Mucor stolonifer Ehrenb. Sylvae Myc. Berol. 13, 25. 1818.

   Rhizopus nigricans Ehrenb. Nova Acta Acad. Leop. **10**[1]: 198. *pl. 11. f. 1–6.* 1820.

2. MUCOR STERCOREUS (Tode) Link, in Willd. Sp. Pl. **6**[1]: 90. 1824.

   Hydrophora stercorea Tode, Fungi Meckl. Sel. **2**: 6. 1791.

   Mucor caninus Pers. Obs. Myc. **1**: 96. *pl. 6. f. 3, 4.* 1796.

   Mucor Mucedo Fres. Beitr. Myk. 7. *pl. 1. f. 1–12.* 1850. Not *M. Mucedo* L. 1753.

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* *L. c.* 7. *pl. 1. f. 1–12.* 1850.

† Fungi Meckl. Sel. **2**: 6.

Southwestern localities visited by Charles Wright

ELMER OTTIS WOOTON

Systematic botanists who have tried to work with the plants collected by Charles Wright in the southwestern portion of the United States, know something of the difficulties arising, (1) from the changes of geographical names which have taken place in that region, and (2) from the fact that very few of the sheets show anything but a single printed label, when one looks for locality data.

Each specimen has a number which is referred to in connection with all those species listed in Plantae Wrightianae. Localities are unknown for practically all the other specimens collected. Each plant was collected under its own separate number by Mr. Wright and his field notes containing these numbers are still in existence; but, unfortunately, the plants were not distributed under the collection numbers. Since the labels do not show localities (and sometimes only the year of collection) it is very difficult it not well-nigh impossible to tell where some of the specimens came from in any but the most general way.

The labels for the 1849 collection say "Collected on a journey from San Antonio, Texas, to El Paso, New Mexico," etc., giving the year and the collector's name. At that time New Mexico was a somewhat indefinite area extending from well down in what is now the state of Chihuahua, Mexico, to and including some of southern Colorado, and including some of western Texas, all of Arizona, and a little of Nevada. The El Paso there referred to is not the present Texan city, but is the ancestor, as it were, of the present-day Ciudad de Juarez, just across the Rio Grande from El Paso, and then known as El Paso del Norte.

In making a study of the flora of New Mexico, it has been my fate to meet many of these labels and to wonder (and work for hours without result) as to whence in all that vast expanse a particular plant had come.

Through Dr. Britton I learned of the existence of Wright's

field notes and numbers, and by the kindness of Dr. Robinson I was permitted to copy them. They did not give me all the information I wanted (because the distribution numbers were not the same as the collection numbers) but they did set my mind at rest upon a few major points. These points are as follows:

1. Practically all of the plants of the 1849 collection were gathered in what is now the state of Texas. Wright *may* have entered what is now New Mexico on the return journey between October 12 and October 20, but this is quite doubtful, since the party apparently went down the river to San Elezario * and then turned eastward.

2. The plants obtained on the 1851 trip were mostly collected in New Mexico (about Santa Rita),† though all the time from September 2 to October 4 was spent on a trip through southeastern Arizona and northeastern Sonora.

3. Nearly all the plants collected in 1852 were obtained in Texas. He made a ten days trip to Lakes Gusman and Santa Maria in northern Chihuahua, and another of four or five days to Fort Filmore and the Organ Mountains, in southern New Mexico.

A new difficulty arises here, since the specimens of the 1851 and 1852 collections were sent out under the same printed label and it is not possible to tell which specimens were collected each year.

Some of the sheets of Wright's plants in Herb. Gray have Wright's collection numbers penciled on them by Dr. Gray, and I have had the ambition for years to run through that herbarium and correlate these with the distribution numbers as thoroughly as possible, but have never had the time nor the opportunity. I have been able to make such a correlation in regard to a few species, thanks to the kindness of Dr. Robinson.

It has occurred to me that a list of the places visited and the dates on which he was there might be of service to others as it has been to myself, and such a list is here appended in the hope of its being welcome to some workers. This list was compiled from the notes using Wright's phraseology (and spellings) in the main. Where possible I have combined dates applying to a single locality.

* Map of Mex. Bound. Survey says "San Elceario." Rand and McNally map of Texas, and other recent maps, say "San Elizario."

† Santa Rita del Cobre, the "Cobre" or "Copper Mines" of Wright's notes.

List of localities visited in 1849

Galveston Island,	Ap 28.
Travis County, west of Houston,	My 5.
Prairies near the Brazos,	My 6.
Brazos bottom,	My 7.
Prairies west of Brazos,	My 8.
Near Mill Creek,	My 9.
Cummings Creek,	My 10.
Rutersville,	My 12.
On the Colorado and along it,	My 15, 18, 19, 23, 24, 25.
Austin,	My 23, 24, 25.
San Marcos,	My 27, 28.
On the Blanco,	My 28.
Guadalupe and New Braunfels,	My 29.
San Antonio,	My 30, 31.
Banks of Medina,	Je 1.
Banks of Hondo,	Je 4.
On the Seco,	Je 5.
On the Sabinal and Frio,	Je 6.
Along the Frio,	Je 7.
On the Leona,	Je 8, 9, 12, 13, 14, 15, 16, 18.
Near the Nueces and westward,	Je 19, 20.
Near Turkey Creek,	Je 21, 23, 25, 26, 27, 28.
Live Oak Creek and to Las Moras,	Je 29.
Live Oak Creek and Elm Creek,	Je 30.
Las Moras,	Jl 2.
Piedra Pinta,	Jl 3.
Zacate Creek,	Jl 4, 5, 6.
San Felipe, along and at the head,	Jl 7, 9.
San Felipe, spring and near the creek,	Jl 11, 13, 17, 19, 20, 21.
Between San Felipe and the Devil's River and on the latter,	Jl 22, 23, 24, 25, 26, 28, 30, 31, Au 1, 2.
Approaching the Pecos,	Au 11, 12.
Valley of the Pecos,	Au 13, 14.
Plains and hills beyond the Pecos,	Au 15, 16.
Valley 20 miles beyond the Pecos,	Au 17.
30, 40, 60 miles beyond the Pecos,	Au 18, 20,
80 miles beyond the Pecos,	Au 21.
Bed of Limpio and along it,	Au 22, 23, 24.
Pass of Limpio,	Au 24, 25, 26.
Mountains beyond the Limpio,	Au 26, 27, 28.
Mountains toward the Rio Grande,	Au 29, 30.
Mountains 30 to 40 miles from the Rio Grande and on to 10 miles from the Rio Grande,	S 1, 2, 3.
Valley of Rio Grande 60 to 70 miles below El Paso,	S 4, 5.
Valley of Rio Grande 40 to 60 miles below El Paso,	S 6.
Valley of Rio Grande 25 to 30 miles below El Paso,	S 7.
Valley of Rio Grande 8 to 10 miles below El Paso,	S 8.

Valley of Rio Grande 5 miles below El Paso,	S 9, 11.
El Paso, on mountains and in the river bed,	S 12, 16, 17.
From El Paso to San Elezario,	S 18.
San Elezario,	S 22, 24, 25, 26.
About El Paso, Isleta, and San Elezario,	O 1, 4, 5, 7, 8, 11.
Prairies 6 to 30 miles east of El Paso,	O 12.
Mountains 30 to 40 miles east of El Paso,	O 12, 13, 14.
Guadalupe Mountains,	O 15, 16, 18.
Eastern base of Guadalupe Mountains,	O 18.
Creek tributary to Pecos,	O 20.
Plains between Guadalupe Mountains and the Pecos,	O 20.
Valley of the Pecos,	O 25, 28, 29, 30, 31, N 2.
Margin of Live Oak Creek.	
Devil's River.	
Spring east of Devil's River (15 miles east of crossing).	
San Felipe Creek,	N 12.
Nueces,	N 13.

List of localities visited in 1851

About El Paso,	Jl 4, 5.
About Frontera,	Jl 9, 18, 19.
Rio Grande bottom above Frontera and at the cottonwoods,	Jl 26.
Valley of the Rio Grande below Doña Ana and at Doña Ana,	Jl 28.
From Doña Ana to San Diego,* the crossing of the river,	Jl 29.
Santa Barbara,*	Jl 30.
From Santa Barbara* to Mule Creek and Cook's Spring,	Jl 31.
From Cook's Spring to Mimbres passing Mimbres Mts.,	Au 1.
From Mimbres to Copper Mine Creek,	Au 2.
Copper Mines (along creek, in mountains and ravines near),	Au 4, 5, 6, 8, 11, 12, 13, 15, 18, 19, 20, 22, 23, 26, 27.
Apache de hoo and Ojo de Vaca, †	Au 28.
Near and at Ojo de Gavilan and on toward Conde's camp,‡	Au 29.
From Ojo de Gavilan to Conde's camp and at the latter,	Au 31.
About Conde's camp,	S 1.
From Conde's camp to Sauz de Cienega, §	S 2.

* Little Mexican settlements about 25 miles north of Las Cruces.

† Apache de hoo probably is the same as Apache Teju (Tayhoó) near Silver City. The R. R. siding is named Apache Tejo. The correct spelling I am unable to find.

Ojo de Vaca is the present Cow Spring, one of the headquarter ranches of the Victoria Land and Cattle Co. near Silver City.

‡ Ojo de Gavilan is Hawk Spring. Conde's Camp was near the Arizona boundary.

§ Sauz de Cienega, should probably be Cienega de Sauz, meaning Willow marsh.

From Sauz de Cienega to the Chiricahui Mts.,*	S 3, 4.
Chiricahui Mts. (sides of),	S 4, 5.
Chiricahui Mts. (pass of and valleys west of),	S 5, 6, 8.
Descending to the San Pedro,	S 8.
San Pedro (on banks and near),	S 9, 10, 11.
Mountain valleys from San Pedro to Santa Cruz,†	S 12.
Valleys of Sonora,	S 13, 14.
Valley of a mountain stream, the Sonoita,	S 14, 15.
On the Sonoita near deserted rancho,	S 15, 16, 17.
Mountains near the San Pedro,	S 18.
Margin of the Barboromori at a deserted rancho,	S 19, 20.
Hillsides from the Barboromori towards Santa Cruz,	S 22, 23.
Valleys near Santa Cruz,	S 23, 24.
About Santa Cruz,	S 24, 25, 26, 27, 28, 29.
Branches of the San Pedro,	S 30, O 1.
Heads of Agua Prieta,	O 1, 2.
San Bernardino,	O 3.
Guadalupe,‡	O 4, 5.
Valley of the Sierra de Las Animas,	O 5, 6, 7.
Las Playas springs,	O 7.
From Las Playas to Copper Mines,	O 8.
Copper Mines (on mountains, hillsides, along the creek, etc.),	O 11, 13, 15, 16, 17, 18, 20, 21, 23.
From Cobre to the Mimbres and along the Mimbres,	O 25, 27.
Cobre, on hills and along creek,	O 28, N 1.
Around the hot springs,	N 2.
Bottom of Mimbres and at Cook's Spring,	N 2.
Mule Creek and "Hole in rock,"	N 3.
Bottom of Rio Grande,	N 4, 5, 6.

List of localities visited in 1852

Prairies of the Rio Grande below San Elezario,	F
Hills, stony and sandy, about San Elezario,	Mr 1–14
Stony hills of cañon leading to San Antonio,	Mr 20–22.
Along Rio Grande,	Mr 22–26.
Hills near Frontera,	Mr 26, 27.
Banks of acequia,§ etc. at El Paso del Norte,	Mr 27–29.
Near Frontera,	Mr 29.
Across river from Frontera (8 numbers in N. M.?)‖	Mr 30.
About Frontera,	Mr 31–Ap 5.
Near El Paso del Norte,	Ap 5.
About Frontera,	Ap 6–15.

* In Arizona.

† In Sonora, Mexico.

‡ In the extreme southwestern corner of New Mexico.

§ Acequia—irrigating ditch.

‖ Frontera was a ranch or small settlement on the east side of the Rio Grande in what is now Texas, a few miles north of El Paso.

* On road to Chihuahua from near El Paso to Cimieluque Sp. 35 miles south,	Ap 17.
* From Cimieluque Sp. to the Salado,	Ap 18.
* Valley of the Salado,	Ap 18.
* Salado to Lake Santa Maria,	Ap 19.
* Lake Santa Maria,	Ap 20.
* Lake Gusman,	Ap 21.
* Lake Gusman to Frontera,	Ap 23.
About Frontera,	Ap 24–27.
† Camp Filmore,	Ap 29.
† Organ Mts.,	Ap 29, 30.
Rio Grande bottom,	My 2.
Near Frontera,	My 3–10.
About El Paso del Norte,	My 10–15.
At Frontera,	My 15–18.
Near El Paso,	My 19.
Near San Elezario,	My 25, Je 1, 2, 3, 7, 9, 14, 15, and 16.
Rio Grande bottom,	Je 17, 18, 19.
Rio Grande at Eagle Spring,	Je 21.
Eagle Spring to Van Horn's Wells,	Je 22.
Van Horn's Wells to Dead Man's Hole and Rain-Water Creek,	Je 23.
Rain Water Creek to Rock Creek,	Je 24.
Rain Water Creek to Limpio,	Je 25.
Head of the Limpio,	Je 26.
Along the Limpio and to Ojo de Leon,	Je 27.
Leon Spring,	Je 28.
Leon Spring to Comanche Spring,	Je 29.
Comanche Spring to Escondido Spring and along Escondido Creek and on to the Pecos,	Je 30.
Valley of the Pecos,	Jl 1, 2.

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* In northern Chihuahua.

† In southern New Mexico.

Tannin cells of persimmons

Burton James Howard

The fact that the tannin in persimmons becomes highly localized during the process of ripening was pointed out by the Japanese investigator Aso * in 1900. He calls the cells "tannin sacs," but all he mentions concerning them is that the tannin is stored in large cells, and he accredits its deposition largely to the action of an oxydase. He also indicates that a browning of the tannin mass also occurs. A still later article upon the subject is that of Tichomirow,† in which certain microchemical characteristics of the bodies are brought out, but apparently this author worked only on ripe fruits, for none of the progressive changes during ripening are noted. Because of the meagerness of some of the facts given it was deemed well to look somewhat further into this phenomenon in connection with chemical work being undertaken by the Bureau of Chemistry, because it was thought it might shed some light on some of the chemical results obtained. Cells of a form somewhat similar to those present in persimmons are present in the Saint John's bread (*Ceratonia Siliqua*) and here also serve for the deposition of tannin. At a recent meeting of the Washington Botanical Society, Mr. Walter Swingle described such cells, occuring in the flesh of the date, which he termed "giant cells" because of their great size.

We have chosen to call these cells tannin cells, for though in some varieties they are very large, yet in others they vary only little from the other parenchyma-cells in their vicinity. In the persimmon the tannin cells occur in the wedge-shaped portions of flesh between the carpels. They appear simply as specialized parenchyma-cells, from which they differ hardly at all excepting in size in the earlier stages of ripening. The shape and size of the

* Aso: A physiological function of oxydase in Kaki-fruit. Bot. Mag. Tokyo 14: 179. 1900.

† Tichomirow: Sur les inclusions intracellulaires du parenchyme charnu de certains fruits. Compt. Rendus Acad. Sci. Paris 139: 305. 1904.

tannin cells vary widely in the American, Chinese and Japanese types. In the wild persimmon varieties of eastern North America, the cells are about the same size and shape as the other parenchyma-cells around them, being nearly isometric in shape (FIGURE 1). The Chinese variety, which was kindly sent us by Mr. Taylor of the Office of Pomological Investigations, was found to contain

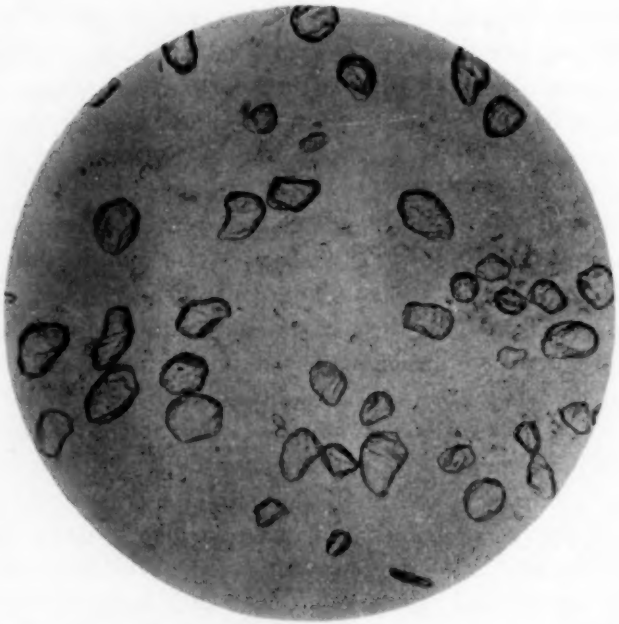

FIGURE 1. Tannin cells from wild American persimmons. × 25.

an immense number of these cells, which were not very greatly different from those found in the American type, though commonly somewhat pointed at the ends (FIGURE 2). The most remarkable tannin cells both as regards size and shape occur in the Japanese varieties. In this type the cells are commonly cigar-shaped, in some cases being five or ten times as long as wide and having an actual length of one millimeter or more (FIGURE 3). If a small portion of the soft pulp from a thoroughly ripened fruit is spread upon a slide or allowed to flow down the side of a test tube, the individual cells can easily be seen with the naked eye. These differences as shown in the different kinds are of especial interest in

view of somewhat similar differences occurring in different kinds of dates, as was pointed out by Mr. Swingle.

In portions of the tissue where these cells occur in great abundance there seem to be special modifications in shape by which nearly adjacent tannin cells are in touch with each other. This is accomplished by small protuberances extending from one cell toward another of like character meeting similar projections from the other cell midway. This is shown in FIGURE 4. Such arrangement seems very manifest in the Japanese variety, from which the

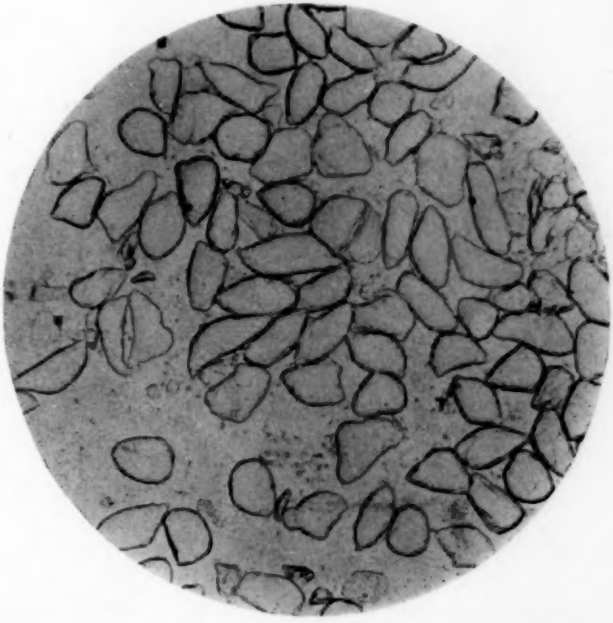

FIGURE 2. Tannin cells from Chinese persimmons. × 25.

illustration was made. The actual communication between the cells seems to be no more free than is usual among parenchyma-cells, inasmuch as only pore-like perforations appear to be present.

For the sake of convenience of description, the ripening process of persimmons may be divided into three stages which shade off by imperceptible degrees from one into the other, viz: the green, the transitory, and the ripe.

In the green stage the tannin does not appear to be strongly

localized, for though it appears most abundantly in the loose parenchyma-tissue where the tannin cells are located, yet it is not limited to these cells nor even to the region where the cells are most abundant. Microchemical tests show that tannin is abundant in most of the cell-sap of the parenchyma-cells and even in the intercellular portions. In this stage it is somewhat difficult to identify the cells which are afterwards to figure as tannin cells except by means of the size and shape, which as noted above strongly differentiate them in some varieties. At this stage the

FIGURE 3. Tannin cells from Japanese persimmons (Kaki). × 25.

cell-contents appear to be in as perfectly liquid condition as any other cells around them.

The second stage of ripening, the transitory, is the one in which the most radical changes occur in the physical and possibly in the chemical constitution of the tannin. This stage in the native American variety is signalized by a slight decrease in the firmness of the fruit, and not long afterward by a marked tendency toward softening. Examination of the tissues in the early part of this

stage will show that most of the tannin is being or has been collected into the tannin cells. The contents of the cells are becoming more highly refractive and from this fact the cells can be identified with considerable ease, even without any tannin test. The middle lamellae have softened sufficiently to allow the cells to be separated without rupturing the walls. At about the middle of this stage a large proportion of the tannin cells show vacuoles between the tannin mass of the cell and portions of the cell-wall (FIGURE 5).

FIGURE 4. Section of Japanese persimmon, showing projections extending between adjacent cells. Tannin cells (masses) dark and somewhat shrunken away from the cell-wall. × 150.

If the material is mounted in the fruit juice these vacuoles remain unchanged, but if water be added the tannin mass expands, fills out the vacuoles, and, if allowed to continue absorbing, there results a rupturing of the cell-wall. This is then followed by part of the cell-contents being forced out into the surrounding media. In the early part of this stage the contents thus escaping mingle readily with water, but later on the material forms a globular-shaped portion on the sides of the cell. Such a condition is shown in

FIGURE 6. There is no definite portion of the cell-wall where rupture occurs; sometimes this happens at one end and at other times at some point along the side of the cell. The form of energy producing the bursting is undoubtedly osmotic pressure, for solutions of fairly strong osmotic power cause no increase in size or bursting when pulp cells are mounted in them. In order to demonstrate this we used glycerine solutions as well as aqueous solutions of

FIGURE 5. Japanese persimmon tannin cells (masses), showing small vacuoles on surface. × 25.

sodium chloride, potassium bromide, potassium iodide and sodium sulphite. Even the tannin reaction with fairly strong iron chloride solution proceeds with exceeding slowness where rupture of some kind has not occurred. It appears that if the iron chloride solution is about isotonic with the solution within the cell, sufficient water cannot pass in to produce rupturing and thus bring the cell-contents in contact with the reagent; and furthermore that the iron salts are prevented, except in comparatively few instances, from passing into the cells and producing the color reaction there.

The above facts show very convincingly why it is that in eating partially ripe persimmons they first produce a fine sweet taste, while it usually takes about half a minute for the taste to detect any astringency; this of course being due to the fact that the saliva, being a liquid of low osmotic strength, causes in a few seconds a swelling and rupturing of the tannin cells and finally the consequent development of astringency. Fruit-pulp in this stage of development if mixed with water changes only slowly. When

FIGURE 6. Tannin cells after bursting, showing tannin globule on side of cells. × 25.

rupturing and contact with water has finally occurred there appear after a short time, even to the naked eye, whitish particles. These on further examination are found to be the expelled cell-contents, which on coming in contact with abundance of water have assumed a white granular condition.

The writer has also observed that solutions considerably stronger than those necessary to maintain equilibrium will produce a shrinking of the cell-contents. This is of course what might be naturally expected when the cause of the swelling is considered.

When the last stage of the change has been reached the tannin masses have a very high refractive power. The addition of water causes but little, if any, swelling, and the contents are friable, pressure upon the cover slip resulting in the fracturing of the tannin mass into irregular fragments (FIGURE 7). These fragments tested for tannin give strong reactions showing that no fundamental change has taken place in the distinctive character of the tannin radical. This stage of ripening is evident to the taste, for all astringency

FIGURE 7. Tannin cells in ripe condition, after pressure has been applied, breaking the mass into fragments. × 25.

has now disappeared. Right here it may not be out of place to call attention to the fact that finally the tannin masses may be either of watery clearness in color or else of dark amber-brown color. There is, however, a difference in surface outline of the two kinds, in that the clear form has a fairly even surface with more or less of slight wrinkling while in the brown type hemispherical hollows in the surface seem to be always present in greater or less extent (FIGURE 8). Hollows are very rarely observed in the clear type. The brown type has not been observed

in any of the wild American fruits. The brown-colored cells are much harder than the clear type, giving in the process of mastication almost the sensation of the stone-cells in some fruits. The reaction with tannin reagents develops more slowly in this than in the clear kind. The brown type of the tannin mass is the only one referred to by Aso, and he considers that it is a result of an oxidation occurring in the tannin during the process of deposition. The present writer, however, fails to see that any such change in

FIGURE 8. Brown tannin masses (cells), showing depressions or hollows. × 25.

color is of necessity connected with the localization of the tannin, but rather thinks that it indicates secondary changes which have occurred after the deposition of the tannin has been completed.

In a few Japanese persimmons sent from the Alabama Experiment Station only one showed these brown tannin masses even when the fruit was firm and strongly astringent. They were also present in the sample furnished by Mr. Fairchilds which had been cured in saki barrels, but we are inclined to believe that the saki had nothing to do with their presence there.

Experiment also demonstrated that fruit packed in a container with vapors of chloroform lost its astringency much quicker than those simply kept in a container without the chloroform, but there was developed at the same time a marked increase in the degree of mushiness.

Another feature which is commonly associated in our minds with the ripening of persimmons, is the development of mushiness. This feature, however, does not run parallel, stage for stage, with changes in the tannin, for it not infrequently occurs that mushiness develops before the astringency is gone, while in other cases just the reverse is true. The latter case is notably so in specimens artificially cured by the saki process. In this method, which is largely employed by the Japanese in ripening their varieties, the fruit is stored for a few days in empty saki barrels. At the end of the treatment it is found that the tannin has all been localized and rendered insoluble in water, though the flesh of the fruit is nearly as firm as that of an ordinary apple. From this it seems that the change in the physical characteristics of the tannin is not at all closely related to the development of mushiness. This makes highly improbable a hypothesis, which we at first thought might be true, namely, that as the middle lamella was rendered soluble in the process of ripening it in some way combined with the tannin, producing a compound insoluble in water. Mr. Gore, of these laboratories, in his studies into the chemical changes occurring during the process of ripening of persimmons, has demonstrated that the sum of tannin and marc (pulp less alcohol-soluble matter) is nearly a constant throughout the process of ripening; from which it seems improbable that the tannin combines with any soluble substance, such as sugar, producing an insoluble compound; for, as shown above, the tannin to the end of the ripening process maintains its power of color reaction toward tannin reagents such as iron salts and chromic compounds.

BUREAU OF CHEMISTRY,
UNITED STATES DEPARTMENT OF AGRICULTURE.

Two new coralline algae from Culebra, Porto Rico

M. Foslie and M. A. Howe

(with plates 23–26)

Since the publication of our paper on "New American Coralline Algae," * the island of Culebra, lying between Porto Rico proper and St. Thomas and now occupied by the United States as a naval station, has been visited by a collecting party from the New York Botanical Garden. Several coralline algae were secured there, including two rather large and conspicuous kinds which are quite different from any hitherto reported from the West Indian region and are, we think, entitled to characterization as new species. Descriptions of these two species are herewith given:

Goniolithon acropetum Fosl. & Howe, sp. nov.

Attached by a rather inconspicuous hypothallus and forming cespitose or difform masses mostly 4–12 cm. high, the single clusters usually 6–15 cm. in diameter, but often confluent and apparently larger; branches repeatedly subdichotomous, much anastomosed, compressed or subterete, 1.25–3.10 mm. in diameter, and subtruncate-capitate, or very often much dilated either at apex only or throughout and then forming flabella or foliar laminae 10–25 mm. broad (including anastomoses) and 1–2 mm. thick or commonly thicker in basal parts, the dilated portions often anastomosing in such a way as to form somewhat tubular or subinfundibuliform communicating interstices, the terminal flabella sometimes crested with short subterete or dentiform innovations; younger branches all conspicuously decutescent, the exfoliations papyraceous, revolute, and more or less concentric or zonate: medullary hypothallic cells 14–40 μ × 11–20 μ; perithallic cells 11–21 μ × 9–14 μ, heterocysts numerous; conceptacles of sporangia subconical becoming mammilliform, about 1 mm. in diameter; sporangia 4-parted, 90–168 μ × 40–102 μ. (Figure 1 and plates 23, 24.)

Growing on corals and on other *Melobesieae* in about 1–4 dm. of water (low tide) in a reef-sheltered cove near the mouth of the

* Bull. N. Y. Botanical Garden 4: 128–136. *pl. 80–93.* 17 Mr 1906.

main harbor of Culebra Island, Porto Rico (M. A. Howe, 3 March, 1906, *no. 4224*).

Goniolithon acropetum is probably most nearly allied to *Goniolithon frutescens* Fosl. f. *flabelliformis*, of the South Pacific, originally described * from Funafuti, but is evidently quite distinct from that species, being coarser,† more anastomosed, often much more widely dilated, and more conspicuously decutescent; the conceptacles of sporangia are somewhat larger (about 1 mm. diameter *vs.* 500–600 μ in *G. frutescens*) and are rather less abruptly conical, and the sporangia attain larger dimensions (reaching maxima of 168 μ in length and 102 μ in width *vs.* 110 μ and 50 μ in *G. frutescens*); the perithallic layer is thicker, and after decalcification the cells of both perithallium and medullary hypothallium appear more rounded at the angles and firmer-walled than in *G. frutescens*.

Conditions of *Goniolithon acropetum* with subterete branches sometimes bear a slight resemblance to forms of *G. strictum* Fosl.,

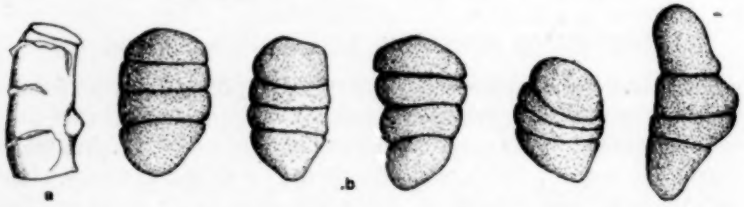

FIGURE 1. *Goniolithon acropetum*; *a*, end of a terete branch showing tetrasporangial conceptacle and exfoliations, × 5; *b*, tetraspores, × 150.

but are coarser, less fragile, and have less tapering branches. A small form of *G. strictum* was found growing within half a mile of *G. acropetum* and was always abundantly distinct.

On the other hand, forms of *Goniolithon acropetum* with dilated, flabelliform branches have a certain superficial resemblance to *Lithophyllum platyphyllum* Fosl. (St. Martin, West Indies) and *Lithophyllum daedaleum pseudodentatum* Fosl. & Howe (Porto Rico), but have really no close affinity with either of these. Both of the last named forms are either not at all decutescent or flake off only minute and irregular scales.

* Det Kgl. Norske Videnskabers Selskabs Skrifter. No. 1. 1900.

† Compare published photographs of *G. frutescens* f. *typica*, in The Fauna and Geography of the Maldive and Laccadive Archipelagoes 1: *pl. 25. f. 4*; and in Coralinaceae Siboga-Exped. *pl. 10. f. 7–9.* 1904.

Lithophyllum Antillarum Fosl. & Howe, sp. nov.

Thallus grayish-pink or decolorate when living, becoming pallid or greenish-pallescent on drying, forming often somewhat columnar rather flat-topped masses 10–30 cm. high and 8–20 cm. broad; branches much fused, forming in the basal parts an almost solid mass with more or less lacunae, the irregular and somewhat daedaleoid anastomoses extending nearly to the irregularly pyramidal, somewhat prismatic, subconical, compressed or occasionally subterete, often truncate or retuse apices, the free portions mostly 5–25 mm. broad and 3–12 mm. thick, often enlarging upward, the interstices commonly tubular or irregularly infundibuliform; surface smooth or subpulverulent, or, especially at the sides, minutely corrugated or rugulose; medullary hypothallic cells 7–18 μ × 7–10 μ, sometimes forming (in a longitudinal section) irregularly alternating rows of one short and two long cells; perithallic cells subquadrate or roundish, 7–10 μ in diameter; short rows of larger cells (20–33 μ × 14–20 μ) occurring here and there in both medulla and perithallium: conceptacles of sporangia convex, but little prominent, 150–300 μ in diameter: sporangia 4-parted, 38–70 μ × 20–40 μ. (FIGURE 2 and PLATES 25, 26.)

Growing at low-water mark on a coral reef at Flamingo Bay, Culebra Island, Porto Rico (M. A. Howe, 7 March 1906, *no. 4373*).

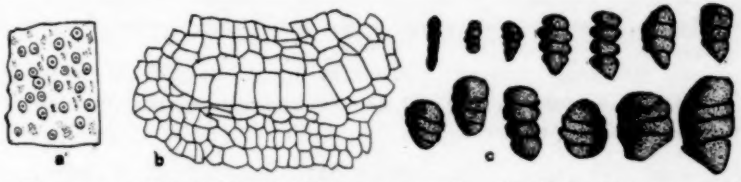

FIGURE 2. *Lithophyllum Antillarum*; *a*, portion of surface with tetrasporangial conceptacles, × 5; *b*, portion of a radio-vertical section, showing row of enlarged cells × 232 (the cells should be more rounded at the angles, as indicated in photomicrograph, PLATE 26); *c*, tetraspores, × 150.

Lithophyllum Antillarum is evidently a reef-builder. In general habit it bears some resemblance to coarse forms of *Lithophyllum africanum* Fosl. (Cape Verde) and to well-developed conditions of *Lithophyllum craspedium* Fosl., a species originally described from specimens brought from Funafuti and since discovered in the Maldives (see Fauna and Geography of the Maldive and Laccadive Archipelagoes, 1: *pl. 25. f. 1*). It is perhaps the more closely related to the latter species, agreeing essentially in structure even to the possession of the peculiar short rows of enlarged cells

apparent at frequent intervals in a radio-longitudinal section (FIGURE 2, *b* and PLATE 26; see also Corallinaceae Siboga-Exped. 59), but the West-Indian plant is rather coarser and is considerably different in habit as will be seen by comparing our photograph (PLATE 25) with that of *L. craspedium* cited above, the branches being more inclined to increase in size upward and anastomosing in a more gyrose or daedaleoid fashion. We believe it should bear a distinctive specific name, at least until further collections give better grounds for understanding the relationships of West Indian forms to those of the South Pacific and Indian oceans. *Lithophyllum africanum* is less coarse than *L. Antillarum*, its branches are thinner, and more frequently subterete or compressed, though sometimes dilated and rather foliar, its medullary cells after decalcification are firmer-walled and more rounded at the angles, and the short rows of enlarged cells are rare.

Explanation of plates 23-26

PLATE 23

Goniolithon acropetum, natural size; the topmost specimen is the type.

PLATE 24

Goniolithon acropetum. Photograph of a sagittal section (decalcified) of a flattened branch, showing perithallium and portion of medullary hypothallium, magnified 165 diameters.

PLATE 25

Lithophyllum Antillarum, natural size, the upper specimen seen from above, the lower from the side; the latter the type.

PLATE 26

Lithophyllum Antillarum. Photograph of radio-vertical section (decalcified) from the medullary hypothallium, magnified 165 diameters. The direction of growth is towards the upper left-hand corner.

INDEX TO AMERICAN BOTANICAL LITERATURE
(1906)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions their kindness will be appreciated.

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